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Crossroads for Steelfounders

Quite a high percentage of Great Britain's steel castings industry is centred in Sheffield and a recent visit to that city enabled us to form an opinion as to the aspirations of, and future prospects for, those engaged in their production. Two foundries gave very encouraging reports as to the reconversion to peacetime productions and in both cases it is now possible to state that only 15 per cent. of the output can be classified as munitions of war. Some foundry executives were, however, deeply worried over the general prospects for the general Sheffield steel industry. Years ago, the late Prof. Arnold described Sheffield as the greatest naval arsenal the world had ever known. That description still holds true. If the atomic bomb reduces the strength of the Navy to that of a fisheries police force, then there will indeed be a void in the production programme which will be difficult to fill. At the moment there are no blast furnaces in the city and liquid pig-iron is to-day a pre-requisite for entering the competitive market for the type of steel required in large quantities. To a lesser extent this will be felt by the steelfoundries, and this, taken in conjunction with the diminished requirements for the War Office, leaves the industry with a potentially excessive capacity. Yet, by astute publicity and much market research, there is a possibility of keeping the industry reasonably well employed.

For many years the steel castings industry has allied itself to iron and steel interests rather than those of the foundry. In the past this was easily understandable, as the former industry possessed an organisation for collecting statistics and generally for taking care of "employer" interests other than wages. In this case reliance was placed on the association covering the whole of the engineering trades. Now there is an important body of thought within the industry which believes that a change should be made and that a closer association should be established with other manufacturers of castings. There is a realisation that to-day the foundry industry in general is fairly well organised. With manufacturers of castings in iron, light alloy and other metals, there are the common problems of sand technique; of moulding and coremaking; of mechanical handling problems; of cleaning; of patternmaking; of costing; of marketing; and of industry representation with Government departments and public-utility bodies. Moreover, much—perhaps a preponderating quantity—of the research work done by the foundry industry as a whole is utilisable by the steel castings section. Again, the quality of the work done would be immeasurably benefited by having the direct and cordial co-operation of the technicians from the steel branch. In purely technical matters, the liaison already exists, and steelfoundry technicians in general are enthusiastic as to the benefits they derive from membership of the Institute of British Foundrymen.

Maybe we have failed to stress the advantages of the close association with iron and steel industries which the steelfoundry has for so many years enjoyed. There has long existed an exceptionally well integrated employers' association capable of giving expert advice, yet we cannot help but feel that, on balance, a real tie-up of foundry interests could not be productive of anything other than mutual beneficial results of outstanding importance.

TO ENSURE THAT a comprehensive range of precision instruments is available for both home and export markets, the Coventry Gauge & Tool Company, Limited, Taylor, Taylor & Hobson, Limited, and E. R. Watts & Son, Limited, have agreed to co-operate in the development and distribution of precision equipment. The three firms will pool their technical and manufacturing resources for the development of new instruments, while the sales and service departments will handle the products of all three firms.

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

OCTOBER 5.

Institute of Welding (South London branch):—Paper by H. W. G. Hignett. At the Edric Hall, Borough Polytechnic, Borough Road, London, S.E.1, at 7.30 p.m.

Keighley Association of Engineers:—"Salt Bath Heat-treatment," by D. Thomas. At Devonshire Buildings, Devonshire Street, Keighley.

Institution of Mechanical Engineers:—"The Early History of the Whittle Jet Propulsion Gas Turbine," by Air Commodore Frank Whittle. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

Manchester Association of Engineers:—Inaugural address by the president, Mr. C. S. Youatt. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

OCTOBER 10.

Institute of Welding (Eastern Counties branch):—"Design and Welding Techniques," by F. Clark. At Ipswich.

Institute of Welding (North London branch):—"X-rays and Their Use in Weld Testing," by Dr. R. J. Barnes and Dr. S. Torrence. At the South-West Essex Technical College, at 8 p.m.

OCTOBER 11.

Institute of Welding (Eastern Counties branch):—"Design and Welding Techniques," by F. Clark. At Norwich.

Institute of Welding (N.E. Tyneside branch):—Chairman's address, by Mr. J. Hogg. At the Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 6.15 p.m.

OCTOBER 12.

Institute of Welding (Birmingham branch):—"Developments in the Welding of Aluminium Alloys," by Dr. E. G. West. At the James Watt Memorial Institute, Gt. Charles Street, Birmingham, at 6.30 p.m.

Institution of Mechanical Engineers:—"The Mechanism of the German Rocket Bomb (V2)," by W. G. A. Perring. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

OCTOBER 16.

British Society for International Bibliography:—Presidential address, "Fifty Years of International Documentation," by Dr. S. C. Bradford. Discussion on the "Technique of Making Abstracts of Scientific and Technical Papers." At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2 at 2.30 p.m.

OCTOBER 19.

Keighley Association of Engineers:—Ladies' night. "Haworth and its Story," by Miss E. Hanson.

OCTOBER 20.

Keighley Association of Engineers:—Visit to Keighley Corporation Electricity Works.

OCTOBER 26.

Manchester Association of Engineers:—"Die Casting from the Engineer's Viewpoint," by M. R. Hinchcliffe. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

Institute of British Foundrymen

OCTOBER 6.

Lancashire branch:—Discussion on "The Specification of Cast Metals," by P. A. Russell, A. E. Peace, C. H. Kain, F. Hudson, A. Phillips. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

OCTOBER 9.

Sheffield branch:—"The Formation of Banded Structures in Horizontal Centrifugal Castings," by H. C. Howson. Joint meeting with the Sheffield Metallurgical Association. At 178, West Street, Sheffield, 1, at 7 p.m.

OCTOBER 11.

East Anglian section:—"High Duty Irons, with Special Reference to Meehanite Metal," by A. H. Horton and J. King. At the Lecture Hall, Central Library, Northgate Street, Ipswich, at 6.45 p.m.

OCTOBER 13.

Scottish branch:—Presidential address by A. Marshall. "The Technological Principles of Casting Design," by Prof. V. M. Shestopal (to be read by D. H. Young). At the Royal Technical College, George Street, Glasgow, at 3 p.m.

West Riding of Yorkshire branch:—Presidential address by J. Timbrell. "Some Experiences with Large Castings," by J. Timbrell. At 1, Mannville Terrace, Bradford, at 5 p.m.

Burnley section:—"Uses of Gases in the Foundry," by H. Haynes. At the Technical School, Blackburn Road, Accrington, at 6.30 p.m.

OCTOBER 20.

Newcastle-upon-Tyne branch:—Presidential address by T. B. Burrows. Three short Papers on non-ferrous, cast iron, and cast steel respectively. At the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6 p.m.

Lincoln section:—"Some Aspects of Modern Foundry Practice," by R. C. Shepherd. At the Technical College, Lincoln, at 2.45 p.m.

OCTOBER 26.

Falkirk section:—"Running Systems for Light Engineering Castings," by R. R. Taylor and D. Fleming. At the Temperance Café, Lint Riggs, Falkirk, at 7 p.m.

OCTOBER 27.

Bristol and West of England branch:—"Duplex Pump Castings," by Brown and Dewhurst. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

East Midlands branch:—"The Quick Immersion Pyrometer in the Cast-iron Foundry," by R. C. Tucker. At Loughborough College, at 6 p.m.

OCTOBER 31.

London branch:—"The Application of Ethyl Silicate to Foundry Practice," by C. Shaw. Demonstrated by N. Shaw. Joint meeting with the Institute of Metals. At the Royal Institution, 121, Albemarle Street, London, W.1, at 7.30 p.m.

ASSOCIATION OF BRONZE AND BRASS FOUNDERS

Following upon the policy enunciated by the president, Mr. G. T. Hyslop, and endorsed by the chairman of the Technical Committee, Mr. P. T. Holligan, the first meeting of the members located in the London area of the Association of Bronze and Brass Founders was held last Thursday. The organisation was carried through by Mr. G. Skript, of Langley Alloys, Limited. The meeting opened with a luncheon at Skindles Hotel, Maidenhead, at which Mr. V. C. Faulkner, Editor of THE FOUNDRY TRADE JOURNAL, was the principal guest. Following this there was a short business meeting, at which technical co-operation was the keynote.

Later, the party, numbering about 25, visited the works of Langley Alloys, Limited, Langley, Bucks. Here, under the personal guidance of Mr. Skript and Mr. Evans, a detailed inspection was made of the hand-moulding and mechanical foundries, the well-equipped core-making section, the patternshop and stores, and the sand testing, physical, mechanical micrographical laboratories. Time was also found to see something of the machine shops and other departments.

At the tea interval Mr. Skript was cordially thanked for his courtesy in throwing open his works for inspection by other members of the industry and for the entertainment he had arranged. This excellent system is not only being carried out in the London area but in other manufacturing centres.

PRODUCTION OF WHITEHEART MALLEABLE IRON BY ANNEALING IN PARTIALLY BURNT TOWN'S GAS*

Annealing time is reduced and difficulties of handling the ore are obviated

By I. JENKINS, M.Sc. (Member), and S. V. WILLIAMS, B.Sc.

(Communication from the staff of the research laboratories of the General Electric Company, Limited, Wembley)

INTRODUCTION

With the improvements in the design of all types of annealing furnaces and the development and more general use of electric furnaces in particular, considerable attention has been directed to the use of controlled atmospheres for various metallurgical processes. Thus the bright annealing of mild steel in cast-iron borings has been more or less completely superseded by bright annealing in controlled atmospheres, with equally good, if not better, results. Case-hardening, until recently carried out mainly in solid carburising compounds, is nowadays done more rapidly in controlled atmospheres. Gas carburising is common practice in America and is gradually being adopted in this country. These two examples do not represent the full extent of the use of controlled atmospheres, but they have been mentioned because they are similar in one respect to the process in general use for the production of whiteheart malleable iron, and which involves annealing white iron castings packed in hematite iron ore. The process has certain obvious disadvantages in so far that it is necessary to heat the iron ore and the heavy annealing boxes, in addition to the actual charge. Furthermore, like bright annealing in borings and pack carburising, the process is inevitably somewhat messy and does not lend itself to very precise control.

Just as case-hardening, in a solid carburiser, is essentially a gaseous process, so the production of whiteheart malleable iron by annealing in hematite ore, is also a gaseous process and any comprehensive study of the use of controlled atmospheres would naturally include a study of malleablising. Controlled atmospheres, for use in conjunction with electric furnaces, have been the subject of research and development work at the research laboratories of the General Electric Company for a number of years, and it is this fact that has resulted in the work discussed in this Paper.

That malleablising is a gaseous process has long been realised and, in fact, as early as 1908 Wüst[1] was granted a patent for malleablising with the aid of gases. More recently, Baukloh and his co-workers[2,3] have published the results of a comprehensive study of the processes involved in the malleablising of unalloyed and alloyed cast iron in various gas mixtures. Baukloh's work definitely confirms that the decarburisation of malleable iron takes place at the surface of the metal and that the process is maintained by diffusion of carbon from the interior to the surface. As mentioned in one of Baukloh's Papers,[3] the pure carbon-monoxide/carbon-dioxide atmospheres used in his experimental work are for economic reasons hardly suitable for commercial annealing of malleable iron, and that it will be desirable to work with gas mixtures produced by special atmosphere plants. This fact was fully realised by the Authors and the work described in this Paper, and which was completed before they were aware of Baukloh's work, deals with the production of whiteheart malleable iron by annealing in partially burnt town's gas.

THEORETICAL CONSIDERATIONS

In the "as-cast" or "white-iron" condition, the castings are hard and brittle, due to the presence of combined carbon in the form of cementite. During the annealing process for the production of whiteheart malleable iron, the object is to remove the carbon or, in other words, to decarburise the castings so as to produce substantially pure and malleable iron. The degree of decarburisation achieved depends on a number of factors, such as the temperature and period of annealing and the section of the castings. With fairly thin castings, complete decarburisation of the iron is obtained in a reasonable time, but with heavier sections a compromise is necessary if the annealing time is not to be excessive and the process uneconomical. This is to ensure that no free, or hyper-eutectoid, cementite remains in the castings and that any carbon in excess of the eutectoid composition is present as graphite. With any particular composition of the cast iron, graphitisation of the excess cementite is a function of the temperature and period of the anneal.

With the normal annealing process, decarburisation is relatively slow and the normal degree of decarburisation aimed at requires a fairly prolonged anneal. Consequently graphitisation of the core of the castings is more or less inevitable. The effect of the section on the structure of whiteheart malleable castings produced by the normal process is shown in Fig. 1. Photo-micrographs of 0.1, 0.2 and 0.3 in. thick material all annealed at the same temperature and for the same

* Paper read at the 42nd annual meeting of the Institute of British Foundrymen, held in London, June 15 and 16, 1945.

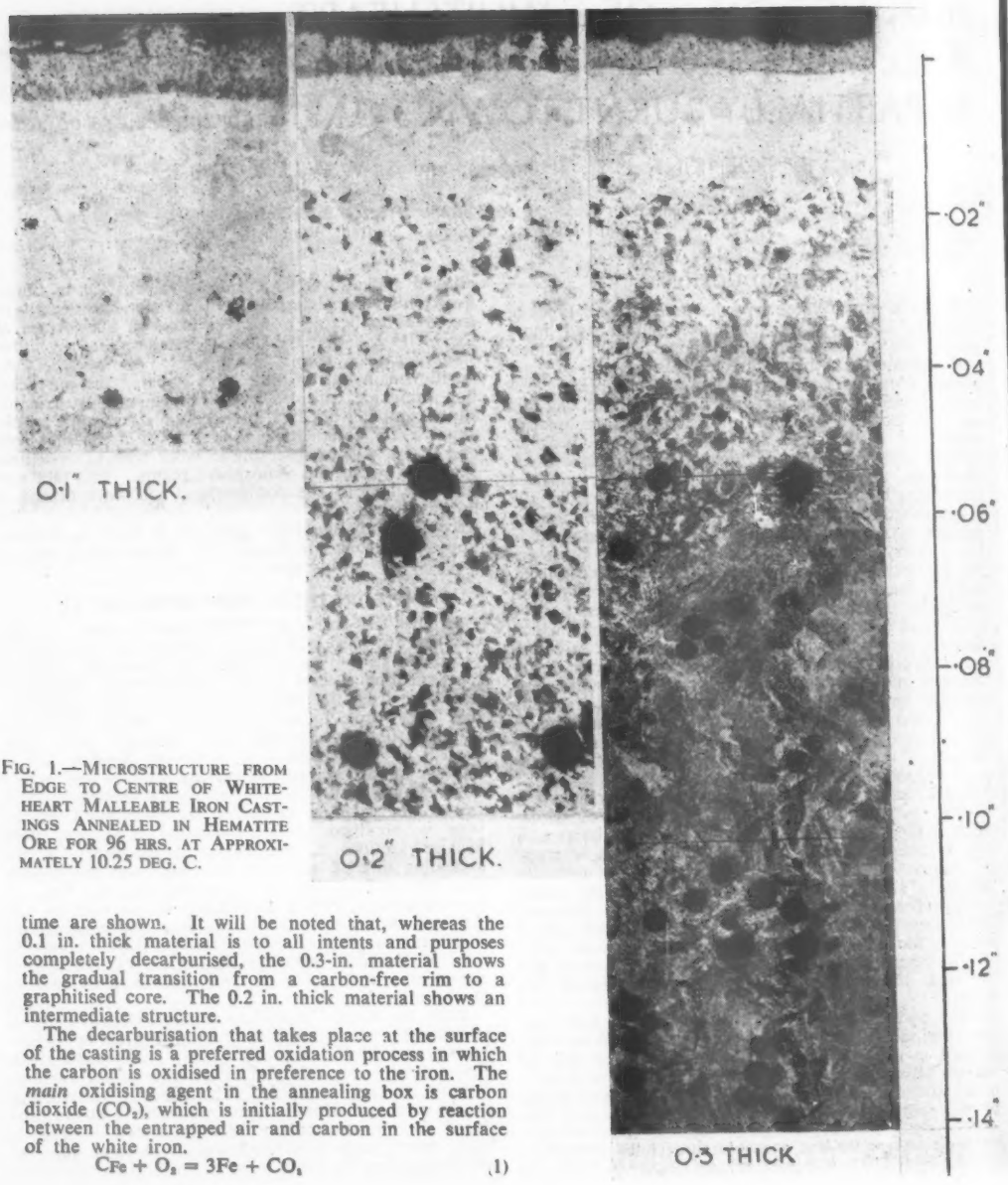

FIG. 1.—MICROSTRUCTURE FROM EDGE TO CENTRE OF WHITE-HEART MALLEABLE IRON CASTINGS ANNEALED IN HEMATITE ORE FOR 96 HRS. AT APPROXIMATELY 10.25 DEG. C.

time are shown. It will be noted that, whereas the 0.1 in. thick material is to all intents and purposes completely decarburised, the 0.3-in. material shows the gradual transition from a carbon-free rim to a graphitised core. The 0.2 in. thick material shows an intermediate structure.

The decarburisation that takes place at the surface of the casting is a preferred oxidation process in which the carbon is oxidised in preference to the iron. The *main* oxidising agent in the annealing box is carbon dioxide (CO_2), which is initially produced by reaction between the entrapped air and carbon in the surface of the white iron.

$$C_{Fe} + O_2 = 3Fe + CO_2 \qquad (1)$$

The CO_2 so produced also reacts with the iron carbide in solution in the iron, according to the following reaction:—

$$CO_2 + C_{Fe} = 3Fe + 2CO \quad (2)$$

The carbon monoxide resulting from reaction (2) reacts with the iron-oxide ore to produce more carbon

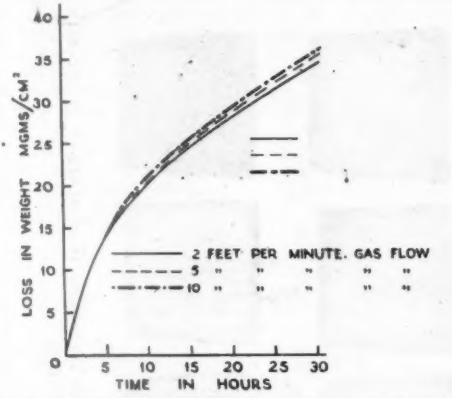

FIG. 2.—RATE OF GAS FLOW ON THE DECARBURISATION OF WHITE CAST IRON AT 975 DEG. C., USING FLAT BARS APPROXIMATELY 0.30 IN. THICK.

dioxide, thus completing the cycle of reactions, which continues throughout the annealing treatment.

$$Fe_2O_3 + 3CO = 2Fe + 3CO_2 \quad (3)$$

It has been suggested that, in addition to the above reactions, decarburisation can result from direct reaction between the ore and the carbide in the iron, as follows:—

$$2Fe_2O_3 + 3C = 4Fe + 3CO_2 \quad (4)$$

In the Authors' opinion, however, this is unlikely.

From the above it is apparent that the main function in the process of the hematite ore is as an indirect source of CO_2 for decarburising the castings. It serves as a reservoir of oxygen which is transferred to the surface of the casting by the carrier gas CO, and this, by adsorption, reacts with the carbon in solution at the surface of the iron. From the nature of the process there is no reason why it should not be carried out in a suitably controlled atmosphere, thus eliminating the use of hematite ore.

Choice of Atmosphere

The atmosphere, however, must be such that, although it will decarburise, it will not oxidise the iron. It is possible to ensure this, since carbon is much more readily oxidised than iron. There are a number of atmospheres which satisfy these conditions, but the most readily produced and cheapest is the range of atmospheres obtained by partially burning a hydrocarbon-rich gas, such as town's gas. Partially burnt town's gas contains the active decarburising gases CO_2 and H_2O, but both of these will also oxidise the iron unless their concentrations are related to those of CO and H_2, respectively, in the atmosphere.

The reactions which govern the selection of the partially burnt gas are as follow:—

$$Fe + CO_2 \rightleftharpoons FeO + CO \quad (5)$$
$$Fe + H_2O \rightleftharpoons FeO + H_2 \quad (6)$$
$$C_{Fe} + CO_2 \rightleftharpoons 3Fe + 2CO \quad (2)$$
$$C_{Fe} + H_2O \rightleftharpoons 3Fe + CO + H_2 \quad (7)$$

The above reactions have been discussed, more particularly in relation to the bright annealing of mild

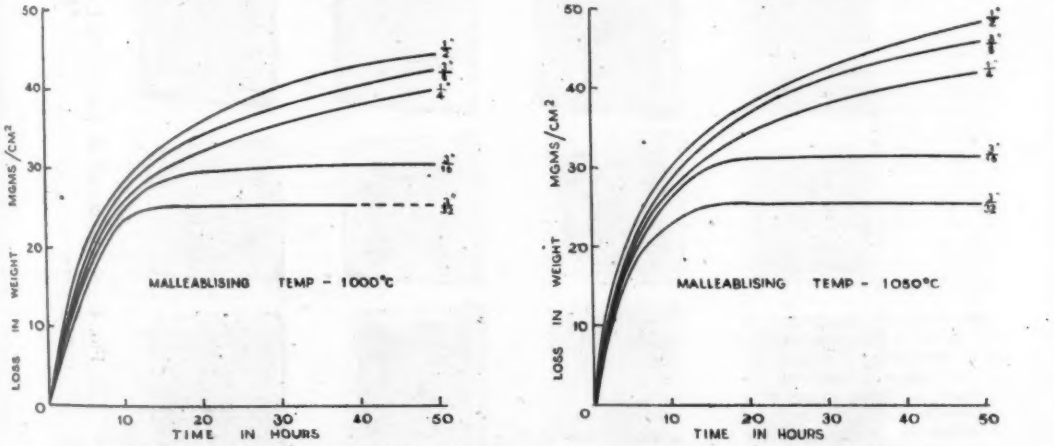

FIG. 3.—EFFECT OF TIME OF TREATMENT ON THE DECARBURISATION OF WHITE CAST IRON

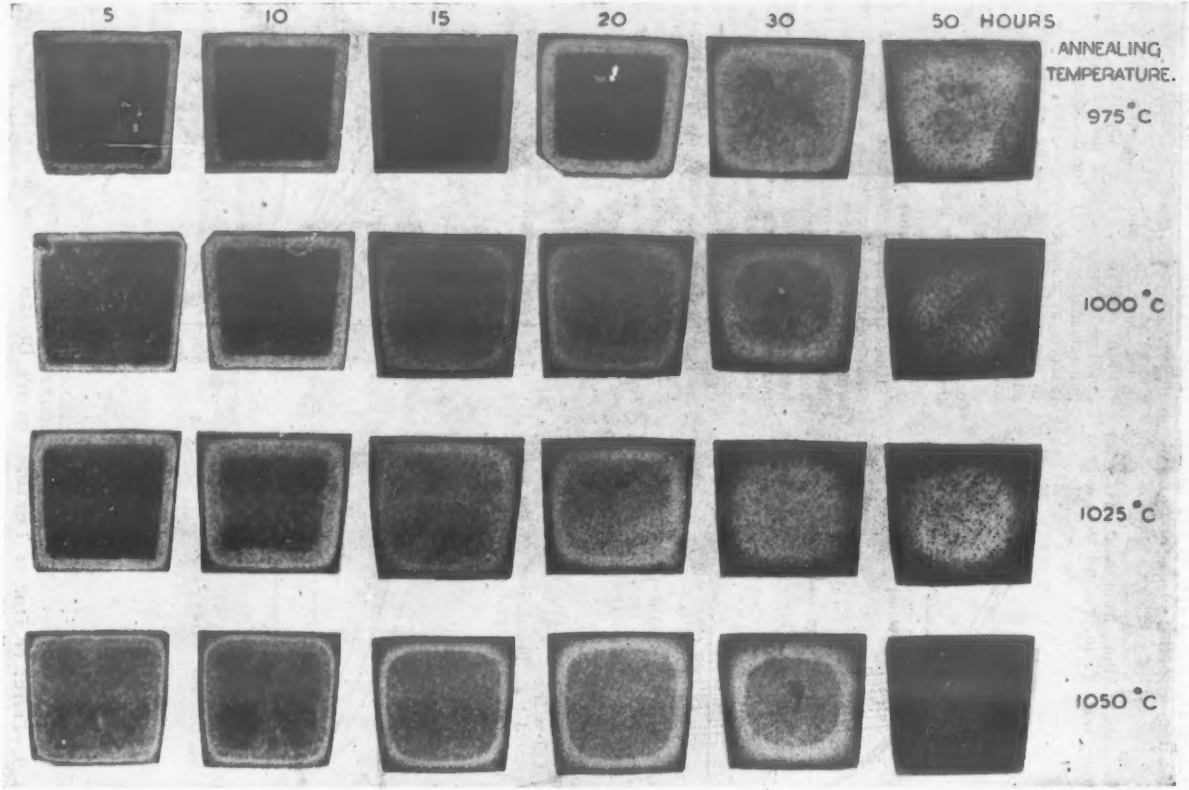

FIG. 4.—MACROGRAPHS OF ½-IN. THICK CASTINGS AFTER VARIOUS ANNEALING TREATMENTS (× 2½ AND REDUCED ONE-THIRD ON REPRODUCTION).

steel, in a previous Paper by the Authors.[4] The same general considerations apply when using partially burnt town's gas for the production of whiteheart malleable. Briefly, these are, that the composition of the atmosphere must be controlled so that there is no oxidation of the iron by CO_2 or H_2O in accordance with reactions (5) and (6). The maximum concentrations of CO_2 and H_2O which can be tolerated without oxidising the iron are considerably in excess of those necessary to ensure rapid decarburisation in accordance with reactions (2) and (7). Thus the selection of an atmosphere suitable for malleablising is determined primarily by reactions (5) and (6).

The partial combustion of town's gas with about twice its own volume of air results in an atmosphere of the composition given below. This satisfies the conditions already specified, *i.e.*, the atmosphere has a strong decarburising power, whilst at the same time it is non-oxidising as far as the iron is concerned.

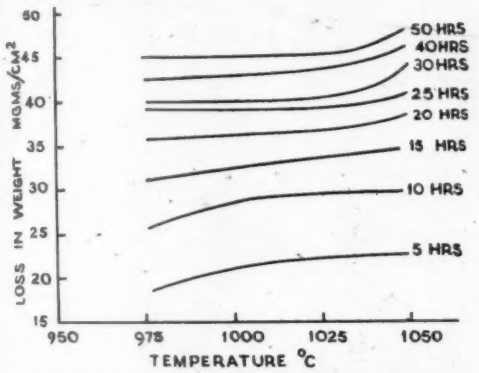

FIG. 5.—EFFECT OF TEMPERATURE ON THE DECARBURISATION OF WHITE CAST IRON (0.5 IN. THICK).

Composition of Partially Burnt Town's Gas.—Air/gas ratio, 2:1; CO_2, 4.6; CO, 9.8; H_2, 15.0; CH_4, 0.8; H_2O, 2.3 per cent.; and N_2, remainder. A number of plants suitable for partially burning town's gas are available, and a typical unit is described in the appendix.

EXPERIMENTAL

In the experimental work on the production of whiteheart malleable iron by annealing in a controlled atmosphere, specially cast flat bars of white iron, 2 in. long by $\frac{1}{4}$ in. wide and $\frac{1}{2}$ in., $\frac{1}{4}$ in., $\frac{1}{4}$ in., $\frac{3}{16}$ in., and $\frac{3}{32}$ in. thick respectively, were used. The chemical analysis of the white iron, as received, was as follows: C, 3.24; Si, 0.52; Mn, 0.16; S, 0.24; and P, 0.07 per cent. Partially burnt town's gas of the composition given above was used throughout the experimental work.

For the purposes of the experiments, single specimens of white iron were annealed under predetermined conditions of gas flow and temperature and for various times in a horizontal multi-tube furnace, the temperature of which was thermostatically controlled to ± 3 deg. C. Prior to annealing, the samples were ground to a smooth finish on all surfaces and degreased in trichlorethylene. The specimens were supported centrally in the furnace tubes on light silica frames, which provided a 3-point support. The usual procedure was to introduce the samples into the furnace tubes, which had already been brought to the required temperature, and then anneal for the requisite period, after which all samples were slowly cooled in the furnace under a positive pressure, but with no flow of gas through the tubes. During the anneal the flow of gas through the tubes was maintained at the desired rate and indicated on orifice gauges.

The following factors were investigated:—Rate of gas flow; time and temperature of anneal; and thickness of casting. The results of the various annealing treatments were assessed by the change in weight of the samples; chemical determination of the total carbon content before and after treatment; and metallographic examination.

Gas Flow

The decarburising reactions (2) and (7) are reversible, and under static conditions the rate of decarburisation will decrease until equilibrium is attained. Thus, in order to ensure that the decarburising process continues at the maximum rate, which is controlled by the rate of diffusion of carbon to the surface, there must be an adequate flow of the decarburising gas over the surface of the specimen. That this condition is not satisfied no doubt accounts for the relatively slow rate of decarburisation with the normal ore annealing process.

For the purpose of determining a gas flow suitable for the subsequent experiments, samples 0.3 in. thick were annealed at 975 deg. C. for periods up to 30 hrs. in gas flows of 2, 5 and 10 linear ft. per min. respectively. The loss of weight of the samples was determined after various times of treatment, and the results are shown in Fig. 2. It will be noted that, although the results show a slight increase in the loss in weight, *i.e.*, decarburisation, with increasing flow, particularly with the longer times of treatment, the difference is not very great. Previous literature on the effect of the rate of gas flow upon decarburisation has not been concordant, and this is probably due to the fact that the actual volume rates of flow are quoted without reference to the cross-sectional area of the reaction tube and the size of the specimen. The rate of flow of gas that matters is that over the surface of the casting, and is best expressed in linear units.

For all subsequent work the rate of gas flow used was 5 linear ft. per min., due allowance being made for the variation in section of the test-pieces. It should be noted that the optimum rate of gas flow is also influenced by the concentration of decarburising gases present in the annealing atmosphere. Generally speaking, the product of linear flow of gas and the total concentration of the active decarburising gases should be constant.

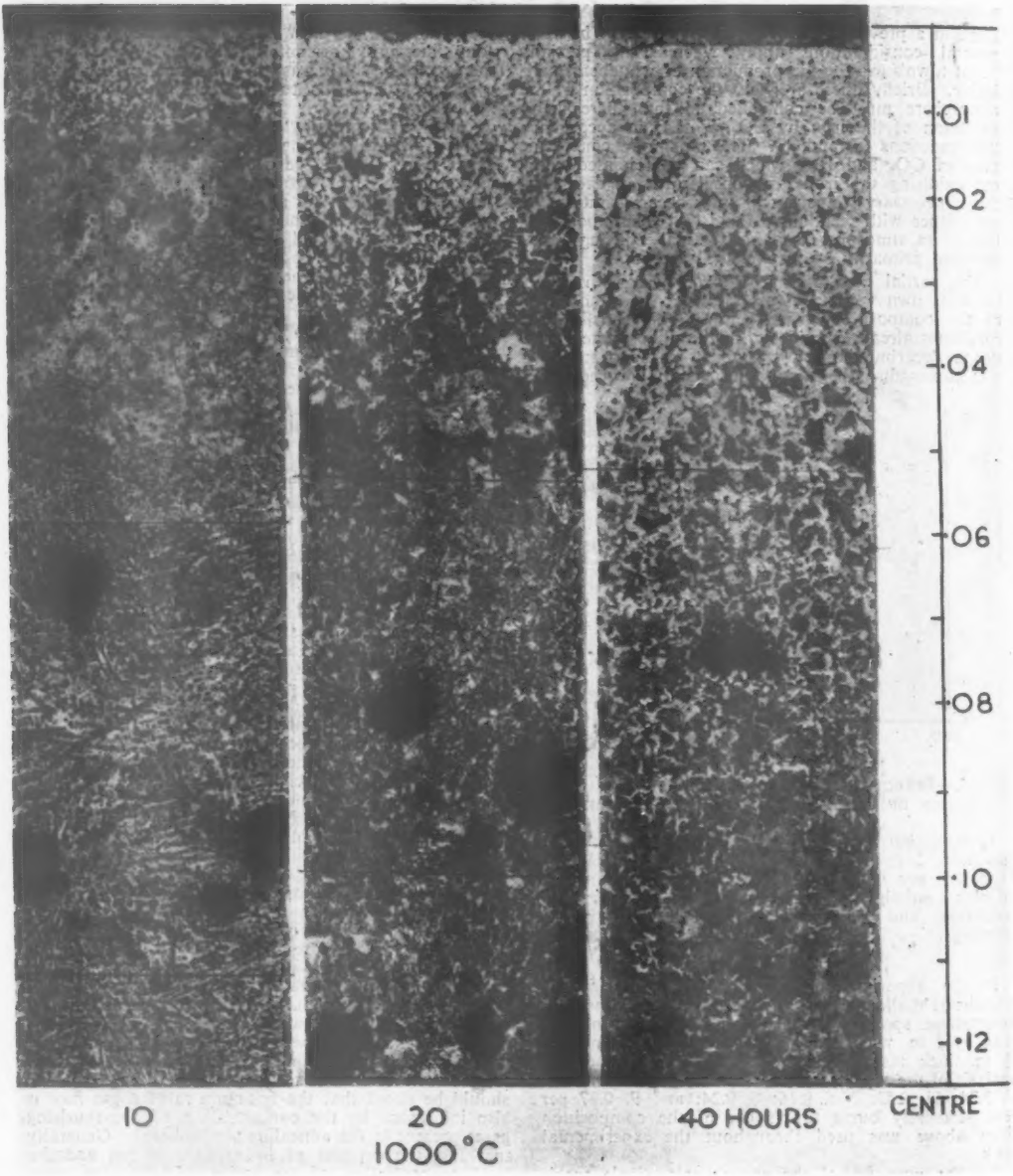

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FIG. 6.—MICROSTRUCTURE FROM EDGE TO CENTRE OF MALLEABLE WHITEHEART CASTINGS AFTER ANNEALING IN TOWN'S GAS FOR 40 HRS. AT 1,000 AND 1,050 DEG. C.

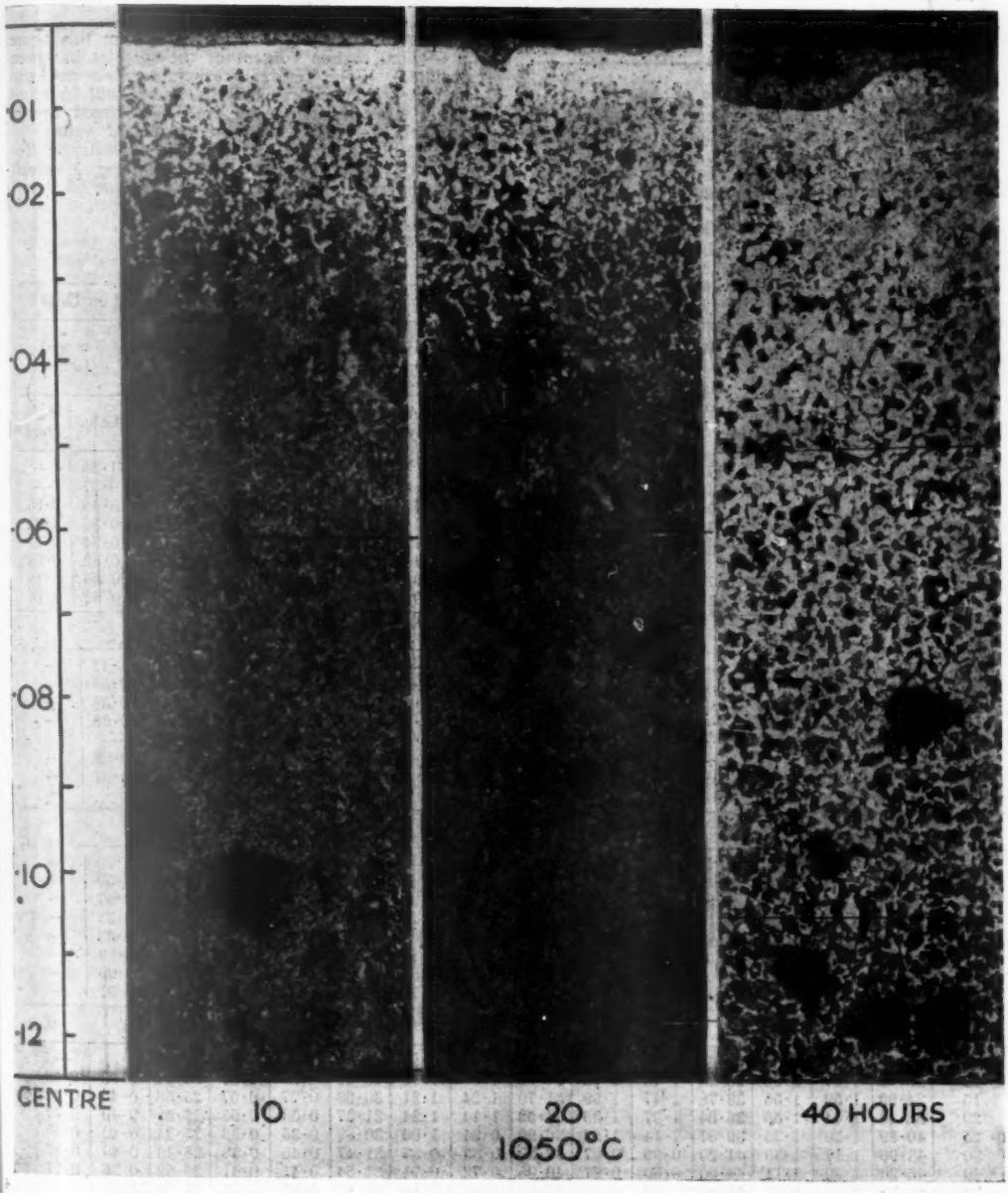

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FIG. 6.—MICROSTRUCTURE FROM EDGE TO CENTRE OF MALLEABLE WHITEHEART CASTINGS AFTER ANNEALING IN TOWN'S GAS FOR 40 HRS. AT 1,000 AND 1,050 DEG. C.

Production of Whiteheart Malleable Iron

Temperature and Time of Anneal

Complete results of experiments to determine the effect of the temperature and time of anneal on the degree of malleablisation with samples of different thicknesses are tabulated in Table I. The table includes the actual loss in weight per unit area of total surface of the specimens, and from this figure the residual carbon content of the samples has been calculated. The residual carbon content was also determined by chemical analysis, and it will be noted that in most instances the values obtained are in reasonable agreement with the calculated values.

The results obtained at 1,000 and 1,050 deg. C. for the various thicknesses are plotted in Fig. 3, which shows the relationship between the extent of decar-

TABLE I.—*Decarburisation of white cast iron. Weight loss and per cent. carbon after treatment. Original carbon content 3·24 per cent.*

Time in Hours	0·5 in. Thick			0·375 in. Thick			0·24 in. Thick			0·188 in. Thick			0·092 in. Thick		
	Wt. Loss Mgms per cm_2	Per cent. Carbon		Wt. Loss Mgms per cm_2	Per cent. Carbon		Wt. Loss Mgms per cm_2	Per cent. Carbon		Wt. Loss Mgms per cm_2	Per cent. Carbon		Wt. Loss Mgms per cm_2	Per cent. Carbon	
		Calc.	Analysed		Calc.	Analysed		Calc.	Analysed		Calc.	Analysed		Calc.	Analysed
975°C															
5	18·10	2·42	2·62	17·57	2·34	2·54	17·05	2·16	—	16·27	1·79	—	15·06	1·35	—
10	25·21	2·09	2·29	24·42	1·90	1·97	23·86	1·75	—	22·40	1·23	—	22·71	0·67	—
15	30·83	1·83	1·83	29·01	1·70	1·78	28·52	1·50	1·65	27·08	1·07	1·07	23·73	0·48	0·66
20	35·07	1·70	1·70	33·50	1·40	1·58	32·12	1·23	1·25	29·42	0·88	0·72	25·49	0·36	0·24
25	38·85	1·55	1·65	36·71	1·30	1·40	34·54	1·02	1·15	29·67	0·63	0·74	25·47	0·34	0·14
30	39·60	1·40	1·48	38·47	1·23	1·27	35·96	0·93	1·12	30·22	0·42	0·66	25·85	0·32	0·23
40	42·38	1·19	1·22	40·50	1·08	1·19	38·00	0·80	0·91	30·59	0·30	0·41	25·25	0·36	0·28
50	45·05	1·06	1·12	42·20	0·92	1·07	39·92	0·68	0·64	30·58	0·30	0·34	25·58	0·32	0·18
1000°C															
5	20·00	2·34	2·51	—	—	—	—	—	—	—	—	—	15·49	1·42	—
10	28·50	1·96	2·16	27·01	1·75	—	25·92	1·56	1·59	25·03	0·96	0·10	23·68	0·58	—
15	32·51	1·74	1·83	31·80	1·47	1·50	29·74	1·38	1·32	28·83	0·63	0·74	25·23	0·38	—
20	36·02	1·56	1·67	34·40	1·35	1·37	31·97	1·20	1·23	29·55	0·54	0·60	25·34	0·28	—
25	39·10	1·42	1·50	36·89	1·26	1·32	34·32	1·04	1·13	29·72	0·50	0·56	—	—	—
30	39·97	1·33	1·47	37·41	1·14	1·23	35·24	0·96	0·94	30·10	0·44	0·46	25·40	0·28	—
40	42·81	1·20	1·28	40·90	0·98	1·01	37·93	0·80	0·80	30·42	0·38	0·42	25·50	0·24	—
50	44·89	1·15	1·11	42·44	0·87	0·94	40·03	0·66	0·73	30·68	0·32	0·30	—	—	—
1025°C															
5	22·36	2·22	—	21·10	2·06	—	19·83	1·88	—	18·80	1·46	1·53	17·40	1·16	—
10	29·44	1·85	1·90	28·64	1·60	1·68	27·43	1·56	1·47	25·06	0·96	0·90	23·15	0·59	—
15	33·41	1·67	1·78	32·80	1·45	1·59	30·54	1·34	1·32	29·03	0·70	0·88	25·00	0·47	—
20	36·25	1·50	1·56	35·65	1·30	1·36	33·15	1·13	1·23	30·21	0·44	0·59	25·11	0·33	—
25	38·95	1·44	1·44	37·00	1·20	1·22	34·30	1·00	1·08	30·60	0·41	0·54	25·09	0·33	—
30	40·23	1·32	1·42	38·95	1·10	1·07	36·23	0·90	0·84	31·25	0·36	0·42	25·42	0·29	—
40	43·25	1·10	1·17	40·51	1·00	1·03	38·20	0·78	0·80	31·65	0·33	0·36	25·38	0·29	—
50	45·19	1·09	1·03	42·48	0·92	1·00	40·04	0·65	0·73	31·84	0·30	0·37	25·27	0·31	—
1050°C															
5	22·55	2·20	2·34	21·60	2·05	2·06	20·03	1·89	1·81	19·58	1·64	1·74	17·49	1·35	—
10	29·62	1·87	1·90	28·25	1·79	1·69	27·82	1·56	1·70	26·26	0·97	1·09	23·14	0·53	0·69
15	34·99	1·59	1·56	33·78	1·47	1·59	31·70	1·24	1·31	30·69	0·77	0·67	25·56	0·40	0·42
20	38·46	1·44	1·50	36·64	1·37	1·35	34·59	1·14	1·24	31·37	0·53	0·63	25·53	0·40	0·37
25	40·89	1·30	1·35	39·57	1·14	1·23	36·99	0·94	1·06	30·88	0·35	0·38	25·34	0·42	0·50
30	43·96	1·17	1·30	41·20	0·99	0·97	38·29	0·83	0·87	31·47	0·45	0·58	25·43	0·40	0·37
40	46·20	1·20	1·11	44·00	0·90	0·97	40·95	0·72	0·74	31·54	0·41	0·41	25·62	0·35	0·27
50	48·59	0·95	1·01	45·90	0·80	0·89	42·08	0·61	0·62	31·52	0·30	0·30	25·78	0·31	0·26

burisation and the time of anneal. The initial rate of decarburisation is quite rapid, and for the first few hours of treatment is almost independent of the thickness of the specimen. With longer annealing periods, however, the rate of decarburisation falls off appreciably and the curves become parabolic. In addition, the loss of carbon per unit area of surface becomes more dependent upon the thickness of the casting. With the thinner sections a condition is reached corresponding to more or less complete decarburisation of the castings, and consequently further annealing does not result in any further loss in weight. The annealing period necessary to bring this about at any particular temperature is determined by the thickness of the casting; thus for $\frac{3}{32}$ in. thick samples about 10 hrs. at 1,000 deg. C. is required, whilst $\frac{7}{16}$ in. thick material requires upwards of 20 hrs. at the same temperature.

graphitisation increases with time, whereas at the higher temperature there would appear to be little increase in the degree of graphitisation after the initial precipitation during the early stages of the anneal. In fact, at 1,050 deg. C., there is a decrease in the number and size of the graphite modules, with increasing time of anneal, as indicated in Fig. 6, which shows the microstructure (× 50) of castings annealed for 10, 20 and 40 hrs. at 1,000 and 1,050 deg. C. respectively.

Thickness of Casting

The effect of the thickness of the castings on the degree of malleablisation is illustrated in Fig. 7, in which the residual carbon content after annealing at 975 and 1,025 deg. C. respectively is plotted. Similar curves are obtained for annealing temperatures of 1,000 and 1,050 deg. C. From these results it is evident that, after the initial rapid rate of

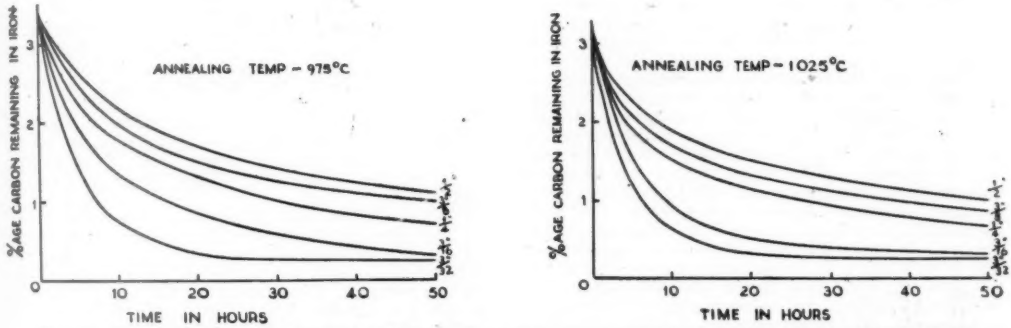

FIG. 7.—RESIDUAL CARBON CONTENT OF WHITE CAST IRON AFTER ANNEALING IN BURNT TOWN'S GAS AFTER VARIOUS TIMES OF TREATMENT.

Graphitisation and the breakdown of the cast structure are functions of the temperature and time of anneal. This is illustrated in the series of macrographs shown in Fig. 4. At 975 deg. C. graphitisation is not evident until after about 20 hrs.' annealing, and about 30 hrs. are required for the breakdown of the cast structure. At 1,000 deg. C. there is pronounced graphitisation after 10 hrs., and little evidence of the cast structure after 15 hrs.' annealing. At 1,025 and 1,050 deg. C. graphitisation is well advanced after 5 hrs., although the breakdown of the cast structure requires nearly 15 hrs.' annealing. The above effects were found to be independent of the thickness of casting within the range studied.

With increasing temperature, the initial rate of decarburisation increases, but after about 20 hrs. and within the 975 to 1,025 deg. C. temperature range the total weight of carbon removed per unit area of surface is more or less independent of the annealing temperature. At 1,050 deg. C., however, there is a significant increase in the amount of decarburisation for annealing times between 20 and 50 hrs., as shown in Fig. 5. At the lower annealing temperatures decarburisation, reduction in the total carbon content of the castings becomes progressively slower for all thicknesses. The curves also bring out the fact that a given residual carbon content is obtained after a considerably shorter anneal in gas than in hematite ore.

REFERENCES

[1] Wüst—German Patent No. 218,307. 1908.

[2] Baukloh, Schulte & Friederichs—Archiv. für das Eisenhüttenwesen 16 Mar., 1943, pp. 341/354. (Iron and Steel Institute Translation No. 158).

[3] Baukloh & Foroud—*ibid.*—16 Mar., 1943, pp. 355/362. (Iron and Steel Institute Translation No. 165).

[4] Jenkins & Williams—G.E.C. Journal, XII, No. 1, 1942, pp. 38–50.

(*To be continued.*)

DR. H. LEPP, the well-known Continental non-ferrous metallurgist, has been visiting this country. As his house was located near the Normandy beaches, D-Day provided for him an unusually exciting experience.

NEW ARRANGEMENTS have been made between France and Belgium with regard to iron ore and coke. France is expected to supply during this month 150,000 tons of iron ore, in exchange for 30,000 tons of coke from Belgium.

SPECIALISATION AND A SENSE OF PROPORTION

BIRMINGHAM BRANCH PRESIDENT'S ADDRESS

The general drift of what was described as a unique address delivered by Mr. A. J. Shore (president) to members of the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen, when they assembled on September 17 for the opening meeting of the session, was that ideas on foundry work are not the monopoly of the conventional foundry subjects taught in technical schools, but that a great deal of light is shed from without. It takes all sorts to make a foundry world, Mr. Shore argued, and they little know of foundries who only foundries know.

"To show what I mean," he said, "let us take an example from window cleaning. Once, in the Austrian Tyrol I saw a woman walk down the village street, carrying under each arm a window. She swilled them under a fountain and then set them to dry in the sun. The windows thus cleaned, she took them back to her house and hung them in position again. It struck me, supposing an English window-cleaner had chosen this village for a holiday—the entry on his registration form describing his occupation, trade or profession, as 'Window-cleaner' would be wholly incomprehensible to the inhabitants. They would be incredulous and not a little tickled to find that he walked round the streets pushing a hand-cart laden with ladders, bucket and leather, and actually climbed up the *outside* of a house to clean the windows—a sight unknown to them, but so familiar to us that we never give it a thought. If we wanted to know the best way to clean windows we should probably consult the 'specialist,' namely, the Window-cleaner. He would, undoubtedly, give us an outline of his own methods. We should be impressed with the speed in which he carried out his job, and would be tempted to invest in a ladder and bucket, whereas attention to window design would probably render the acquisition of additional plant unnecessary.

"Now, how often, say, has money been spent on dressing shop labour and grinding wheels, which could have been more profitably employed on pattern design? Though cleaning windows is far removed from foundry work (generally very far indeed), I submit the principle involved in the foregoing observations is just as usefully thought-provoking to the foundryman as, say, Boyle's Law. Those who shape the destinies of the Institute evidently had the value of 'ideas-from-outside' in mind when they instituted the Edward Williams Memorial Lectures. The subjects chosen are designed with a view to broadening our knowledge and they are generally delivered by thinkers from *outside* the industry.

"And now our national president, Mr. Gardom, has sought to widen the experience of younger foundrymen in a very practical manner by helping them to attend meetings of the Institute's technical committees. In this way, not only do they improve their technical knowledge; they have to travel and get familiar with hotels also.

Spiritual Development

"Man is often represented to be a combination of body, mind and spirit. There has been a tendency in modern civilisation to concentrate on the things of the body and mind and neglect those of the spirit. We pride ourselves on our scientific progress, but have we advanced spiritually at all during the last 2,000 years? With the discovery of a means of liberating atomic energy, stupendous physical powers have been brought within our grasp; it has even been suggested we are on the threshold of a new age and that civilisation now has a means of committing suicide at will. These are solemn thoughts which cannot fail to affect each one of us as individuals. As individuals, however, we are by no means impotent; we can have a say in the matter, too.

"A neutron is a very small entity and, if it could think, would probably not regard itself as much of a 'big shot.' Yet a neutron, properly directed, penetrates the atom-nucleus and sets free energy and more neutrons. When the conditions are right, the effect is cumulative and the result shattering and cataclysmic. So, too, with men and ideas. An idea in itself may seem a small thing, but once set going it can build up or destroy a nation. It is the ideas we have as individuals which eventually determine the destinies of mankind in general and, if we plan with no regard for moral and spiritual values, even in seemingly trivial matters, I for one believe we shall come to nothing.

"A sense of proportion guiding us to a true eutectic of body, mind and spirit is, I feel, an urgent necessity at the present stage of world affairs, and any activity which leads to this end should be encouraged. To my mind, it is no accident that the Institute of British Foundrymen has for its motto 'Science Hand in Hand with Labour'; a sentiment which combines in a very pithy way the three ingredients we have been considering—'Science,' of the mind; 'Labour,' of the body; and the spirit of mutual help implicit in the phrase 'Hand in Hand.'

Scope of the Institute

"Nowhere, I think, is a society better fitted to broaden ideas around a central theme, offer a field for mutual help, or promote a sense of proportion than the Institute of British Foundrymen. Many technical and professional bodies often exclude from membership all other than university graduates, or those holding academic certificates, whereas the Institute presents a cross-section of the industry and welcomes moulders, managers, salesmen and metallurgists; in fact, anyone with a true interest in the foundry business. What I am most anxious about is that these facilities should be exploited to the full. Let us resolve, then, to take part in discussions. When we have ideas, let us not hesitate to air them. Do not wait for the other fellow to ask our question."

A vote of thanks to Mr. Shore was proposed by Mr. A. G. Harrison, and seconded by Mr. H. G. Hall, who said that, if we could get specialisation, plus pride of workmanship, a big stride forward would have been made. The vote was heartily accorded.

HIGH TENSILE STEEL FOR CASTINGS*

Analogies with forged steel provide useful pointers for progress

By W. WEST, C. C. HODGSON and H. O. WARING

(*Continued from page* 80.)

Mould Sand

Dry sand moulding is general in this steel foundry. The sand system is not yet fully mechanised, consequently in the preparation of sand a rather large proportion of new sand is required to counteract the cumulative effect of silt and to ensure the most satisfactory results. The facing sand and backing sand are prepared, at the present time, separately. About a third of the total sand in circulation is prepared facing sand. The backing sand is reconditioned on the knock out floor and returned to the moulding section. A portion of the knocked out sand is returned to the sand mill as old sand.

The bases of the moulding sand are a strongly naturally-bonded sand containing 20 to 25 per cent. of clay, and a clean washed silica sand of medium grain fineness. For the preparation of facing sand a Smedley mill with two 10-cwt. rollers is used. Sand is milled for 4 mins. and then passed through an aerator. The ordinary mould sand is made up of old and new sand in approximately equal amounts. In practice the proportion of new sand varies between 40 and 60 per cent. as required to keep the properties constant. The new sands are added separately to the mill, but usually in the ratio of six parts of the bonded sand to four parts of the silica sand. If an all-new sand mix was required for some special job this 6 : 4 mixture would be used.

The laboratory has the responsibility for the correct preparation of the sand. Samples of new sand as delivered are taken at intervals to check their chemical and physical properties. About half the mould sand mixtures made each day are tested; the A.F.A. Standard methods and testing apparatus are used. Tests are carried out on each sample to determine moisture, green compression strength, dry permeability and dry compression strength. The clay content is determined periodically by the A.F.A. method. The desired properties are:—Moisture, 7 per cent.; green compression strength, 7 per sq. in.; dry permeability, 120 A.F.A. No.; dry compression strength, 250 lbs. per sq. in.; A.F.A. clay content, 15 per cent. These test figures have been found after much experience to be linked up with the best all round results from the sand. The figures obtained from the daily tests are recorded in chart, and are accompanied by a record of changes in the mixture and notes of any defects that could be attributed to the sand.

Sand Properties

In defining the best properties of the mould sand, consideration must be given to the type of moulding (*i.e.*, machine or hand rammed), the degree of ramming, effect on pattern drawing, and the designs of castings in production. The most desirable permeability or the highest dry strength obtainable with mixtures of the two sands are not those of the most workable sand. For instance, the effect of moisture on properties is such that the dry strength increases as the amount of moisture present at the time of milling is increased, but the sand is not so workable with the higher moisture content. With a higher proportion of the bonded sand the sand becomes too tough and difficult to ram, and the higher dry strength obtainable is offset by the loose ramming of those parts of the mould where a high dry strength is most needed.

When high dry strength is desired, bentonite or cereal binder may be added to the mixture without greatly affecting the permeability, and it has been found better to increase strength in this way rather than by making a big increase in the proportion of naturally bonded sand with its accompanying lowering of permeability. As will be seen from the data in Table VIII, the maximum dry compression strength obtainable in the A.F.A. specimen with the naturally bonded sand alone is only 250 to 300 lbs. per sq. in., and although

TABLE VIII.—*Properties of Sand Mixtures Used.*

Natural Bonded Sand. Per cent. by vol.	Washed Silica Sand. Per cent. by vol.	Old Sand. Per cent. by vol.	Bentonite. Per cent. by vol.	Cereal. Per cent. by vol.	Green Comp. Strength. Lb. per sq. in.	Dry Perm. A.F.A. No.	Dry Comp. Strength. Lb. per sq. in.
30	20	50	—	—	7.0	120	250
60	40	—	—	—	7.2	120	300
60	40	—	1.0	—	7.7	115	350
60	40	—	—	1.0	8.0	110	450

* A Paper read before the Lancashire branch of the Institute of British Foundrymen, Mr. Stanley Brooks presiding. The Authors are on the staff of Leyland Motors, Limited.

this is high enough for many purposes, it may be increased to 350 or 450 lbs. per sq. in. if required by the addition of 1 per cent. by volume of bentonite or cereal binder. These may also be used to keep up the strength, whilst the permeability is improved by an increase in the proportion of the larger grain silica sand.

When the permeability falls below 80 (A.F.A. Number) scabbing will occur on hard-rammed surfaces. A low permeability is usually an indication of an excess of silt in the sand, and is accompanied by a tendency for sand to fuse and adhere to castings. These troubles will occur if too great a proportion of old sand is being retained in circulation.

Core Sands

A large number of core sand mixtures can produce satisfactory results in the steel foundry, depending upon the circumstances in which they are used. Most of the work can be produced with three main mixtures, with modifications to meet the requirements of any special work. Three clean silica sands are the bases of all the core sand mixtures, and no reclaimed sand has been used. The sands are:—Leighton Buzzard (No. 1 coarse); Chelford, and Southport Hill sand. These three sands may be mixed or interchanged to bring about variations in permeability.

For most purposes the sand bonded with 3 per cent. of semi-solid core cream gives satisfactory results. This mixture has a fairly high green bond strength, which makes it suitable for most designs, so far as the core making is concerned. Where a specially weak core is required to avoid the formation of strains or hot tears a sand bonded with a cereal and pitch binder plus linseed is used. It has a low hot strength. When it is necessary to have a strong core together with the minimum hot strength it has been found advantageous to have as high a proportion of coarse sand as possible in the mixture, as the increased rate of flow of hot gases through the cores promotes a rapid disintegration of the sand.

The average properties of the core mixtures are shown in Table IX, but these are modified somewhat by the grain size of the sand when a fixed amount of binder is present.

Methods of Feeding

Much attention has been paid during the last few years to methods of feeding in an endeavour to get hot metal where it is wanted for feeding without introducing difficulties which more than offset the advantages gained, the whirlgate head and atmospheric pressure head are two of them. The thanks of foundrymen should go out to the investigators who have worked on these problems. It is not intended here to attempt any discussion, but to point out a difficulty which is sometimes met when the top of the atmospheric head is at a level considerably lower than the top of the casting to be fed.

The steel in its passage through the mould usually collects a certain amount of sand and refractory material which floats upwards on the surface of the rising metal; if the top of the mould is closed this

TABLE IX.—*Average Properties of Core Sands.*
A.F.A. Specimens baked 1 hour at 200 deg. C.

Sand Mixture (per cent. by weight).	Green Comp. Strength. Lb. per sq. in.	Dry Perm. A.F.A. No.	Dry Comp. Strength. Lb. per sq. in.
Chelford Sand Semi-solid Core Cream .... 3.0 per cent.	2.5	200	1,500
Chelford Sand Cereal and pitch compound .... 2.0 per cent.	2.0 to 2.5	200	400 to 800
Raw Linseed Oil .... 0.25 to 0.75 per cent.			
Water .... 4.0 per cent.			
Chelford Sand .... 50 to 100 per cent.	1.5 to 2.5	200 to 300	2,000 to 3,000
Leighton Buzzard .... 0 to 50 per cent.			
Cereal .... 1.0 to 1.5 per cent.			
Silica Flour .... 1.0 to 1.5 per cent.			
Raw Linseed Oil .... 1.0 to 1.5 per cent.			
Water .... 4.0 per cent.			

pasty or liquid slag is trapped against the top surface, and may form a hot spot which will keep the metal around it hotter for a time than the rest of the freezing and cooling envelope, long enough perhaps for the runner to freeze whilst the steel around the small hot-spot is still plastic enough to burst through by atmospheric pressure, and the conditions now being the same both in casting and head feeding can no longer take place. When repeating some of Taylor and Rominski's experiments[12] on a casting similar to one of theirs in shape and method of running and feeding, the Authors found some good examples of this behaviour. A casting 9 in. high by 1¼ in. by 3 in. connected to a side head and intended to be fed by atmospheric pressure is shown in Fig. 17. After solidifying to give a uniform layer of about ¼ in. of solid steel, there appears to have been a rapid subsiding of the still liquid metal in the casting: examination showed the atmosphere to have had access to the interior of the casting by means of a fine pin hole connecting at the surface with an area that had been kept hot by a small globule of slag or fused sand. The level of the metal in the casting has not fallen as low as one would have expected, for although having a somewhat porous structure below the main cavity (the porosity is not shown clearly in the photograph), the metal was sound at a level of about 1 in. above the top of the blind riser. Without going into possible explanations for the peculiarities in behaviour, the example illustrates one of the dangers to be guarded against with this type of feeding. When a chill was placed at A, thus ensuring quick freezing at the surface where hot-spots might occur, the casting solidified solid with atmospheric pressure feeding.

It has become usual to regard the method of feeding which uses hydrostatic head and gravity as "gravity feeding" and the vented blind head and closed mould as atmospheric pressure feeding, but it may not be out of place to remark in passing that each of these methods depends on gravity, the pressure exerted by the atmosphere is itself dependent on gravity.

Quality

The future for the use of steel castings is quite good, but it will only be developed on the basis of quality, and it is on this particular point, failure to satisfy the user, that much trade has been lost to the drop-forging and malleable-iron industries. Certain sections of the engineering trade would welcome steel castings if there was greater certainty of consistency in the physical properties of the steel, much fewer blowholes, and less porosity in the sections, with cleaner delineation of the outside shapes.

Loss of money and production to the user is not measured by the number of rejected castings, but by the total time in addition spent on machining the pieces which in many cases are on the point of completion before the need for rejection becomes apparent.

Radiological Examination

To meet the position the Authors hope shortly to establish the practice of radiological examination much on the lines adopted by the light alloy industry, wherein most important castings for aero engines and under carriages have been produced in large quantities and under meticulous inspection. Most founders in metallic alloys have difficulties with the manufacture of castings for prototype designs, but the time factor of delivery generally allows some latitude for experimenting to overcome them. In competitive business for production quantities, such help is not available, and more often than not the foundryman has to call upon his past experience to decide upon the best way of making, without any immediate proof of success, before an appropriate quantity has been delivered to the customer.

The assistance needed, therefore, can be had by radiological examination. Where strange designs are to be made without delay in production quantities,

FIG. 17.—SHOWING A DEFECTIVE RESULT WHEN EXPERIMENTING WITH THE WILLIAMS' SYSTEM OF RUNNING.

the plan of examination recommended is that the first six castings produced should be X-rayed; usually results can be obtained the day following. The more powerful the X-ray unit the quicker can results be given; for steel castings in particular, a machine of 400 k.v.a. will meet an all round purpose.

In this way direction is given whether a revision

(*Continued overleaf, column* 1.)

DORMAN, LONG & COMPANY

FOUR SPECIAL DIRECTORS APPOINTED

The appointment of four senior officials to be special directors is announced by Dorman, Long & Company, Limited. They are Mr. G. E. Chicken (commercial manager), Mr. J. F. Pain (manager of the bridge department), Mr. F. L. Shepherd (operations superintendent, iron and steel works), and Mr. L. Shuttleworth (manager, distillation and by-products department).

These latest appointments represent a further development of the company's policy of drawing senior officials into closer association with the board in the direction of the varied activities of Dorman, Long & Company.

Mr. G. E. Chicken, who has recently succeeded Mr. A. MacLeod as commercial manager, is well known in the iron and steel industry, having been for some years a director and commercial manager of the Appleby-Frodingham Steel Company, Limited, Scunthorpe.

Mr. J. F. Pain, who is one of Britain's leading bridge designers, served with Sir Douglas Fox & Partners and was in charge of the calculations for the design of the Sydney Harbour Bridge. He joined Dorman, Long's bridge department in 1927, became chief draughtsman and designer, and was appointed manager of the department in 1944.

Mr. F. L. Shepherd joined Dorman, Long & Company in 1911 as an engineering apprentice at the Britannia Works. He went to the Redcar works during their construction in 1916, subsequently holding managerial appointments at the Acklam, Britannia and Newport works and becoming general works manager in 1936.

Mr. L. Shuttleworth's first appointment with Dorman, Long was in 1920 as chief assistant chemist at the distillation and by-products department. He later became works manager and was appointed manager of the department in 1940.

HIGH TENSILE STEEL FOR CASTINGS

(*Continued from previous page.*)

of the method of making is necessary. Where the correct line has been adopted or is ultimately achieved, the process of examination is continued over 50 per cent. of, say, the first 50 or 100 castings produced.

Should the results from the larger quantities be satisfactory, then it is a fairly safe basis upon which to proceed for larger production; it is advisable then to take samples at random to ensure continuity of quality until the completion of the order.

The interpretation of the results of radiological examination is simplified by acquaintance with the negatives produced. When full access to them is given to the foundrymen, it is surprising how quickly he becomes so minded to use such examination, and be guided by what he sees for himself.

REFERENCE

[13] H. F. Taylor and E. A. Rominski. Atmospheric Pressure and the Steel Casting—A New Technique in Gating and Risering. T. of the A.F.A., 1942, vol. 50, p. 215.

MORE GOVERNMENT FACTORIES ALLOCATED

Twenty-four more Government factories, with a total area of about 4,000,000 sq. ft., have been allocated for civilian production. They include:—

North Seaton, Ashington, and Hebburn-on-Tyne, A. Reyrolle & Company, Limited, electrical equipment.

Braunstone, A. A. Jones & Shipman, Limited, machine tools.

Newark-on-Trent, Ransome & Marles Ball Bearing Company, Limited, ball bearings.

Watford by-Pass, Savage & Parsons, Limited, electrical equipment.

Lydney, Glos, Western Motor Holdings, Limited, bus bodies and kitchen equipment.

Newport, Uskide Engineering Company, Limited. heavy engineering and general marine engineering.

Bangor, British Electric Meters, Limited, household electric meters.

Newcastle-under-Lyme, British Thomson-Houston Company, Limited, electric appliances.

Warwick, Emscote Foundry Company, Limited, general foundry work.

Tipton, Newey & Tayler, Limited, metal smallwares.

Coventry, Dunlop Rim & Wheel Company, Limited, wheels, brake-drums and cycle rims.

Walton, Liverpool, D. Napier & Son, Limited, and English Electric Company, Limited, aero engines and electrical engineering.

Oldham Integral Pump Company, hydraulic equipment.

Bromborough, Fawcett, Preston & Company, Limited, machinery and marine engines.

Clayton-le-Moors, Courtaulds, Limited, textile machinery and processing of yarn.

Ulverston, C. G. Wade, Limited, metal furniture.

Glasgow, James Howden, Limited, kitchen equipment and light engineering.

Glasgow, Brown & Adam (Engineers), Limited, household equipment.

WROUGHT LIGHT ALLOY MANUFACTURE IN WALES

Negotiations for the purchase by Imperial Chemical Industries, Limited, of the Waunarlwydd factory at Swansea from the Ministry of Aircraft Production have now been completed. The factory, which was constructed and operated by the Metals Division of I.C.I. on behalf of the Ministry for the manufacture of wrought light alloys required primarily for the Government's aircraft programme, will give regular work to a considerable number of local men and women; already 1,000 are employed. It is being maintained to cope with the prospective peacetime requirements for wrought light alloys in the transport industries (land, sea and air), general engineering and housing, in which activities the largest tonnages are likely to be absorbed. Over the next few months productive effort will be concentrated largely on material for the housing programme.

The High-Quality Iron for High-Duty Castings.

Made in seven standard grades or to individual requirements, this iron has a close grain structure and fine graphitic carbon content. It replaces Hematite, and tones up high phosphorus irons.

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PERSONAL

MR. HARRY SUMMERSGILL has changed his address to "Cawood," Apperley Bridge, Bradford.

MR. D. BASCH, the well-known American metallurgist, has been appointed consultant to the group of companies headed by Col. W. C. Devereux.

DR. J. E. HURST, J.P., a past-president of the Institute of British Foundrymen, has consented to be the next Sheriff for the City and County of Lichfield, an office which has been in existence for nearly 400 years.

MR. JAMES CARSON has been elected a director of Stewarts and Lloyds, Limited, and appointed assistant general managing director in charge of tube production to take the place of Mr. A. G. Stewart, now chairman and general managing director.

DR. J. H. CHESTERS has been awarded the Degree of Doctor of Technical Science by the University of Sheffield, for his outstanding researches on refractories. Dr. Chesters' book on "Steelplant Refractories," published in January of this year, has already been accepted as the standard text-book on the subject. For the last 11 years he has been in charge of the refractories section of the Central Research Department of the United Steel Companies, Limited.

PROF. R. P. LINSTEAD, F.R.S., has been appointed to be Director of the Chemical Research Laboratory in the Department of Scientific and Industrial Research. He will take up this appointment on October 1. In 1942, Prof. Linstead became Deputy Director of Scientific Research in the Ministry of Supply. During the past year he was British chairman of the Combined Intelligence Objectives Sub-committee, which was responsible for organising the investigation of German military scientific developments.

MR. VINCENT DELPORT has relinquished his post of secretary of the Council of Ironfoundry Associations and has resumed his full duties as managing director of the Penton Publishing Company, Limited. Mr. Delport has been appointed honorary public relations officer of the Joint Iron Council. He has been succeeded as secretary of the Council of Ironfoundry Associations by MR. T. E. PARKINSON. MR. T. CLARK has taken up his duties as secretary of the Council of Iron Producers. Both Mr. Clark and Mr. Parkinson are acting as joint secretaries of the Joint Iron Council.

LT.-CMDR. LEONARD JOLLY, R.N.V.R., who has been twice mentioned in despatches, has been awarded the D.S.C. In civil life he is sales manager to Leigh & Sillavan, Limited, of Manchester. Lt.-Cmdr. Jolly has been engaged in mine sweeping and other naval operations since the early days of the war and has served in British and American waters, in the Pacific and in the Atlantic oceans. He was at one time in H.M.S. "Lorna Doone," which may be remembered as having had the honour of bringing down three Dorniers in one day, and at a later date commanded this vessel. His present ship, which he commands—H.M.S. "Elfreda"—was in the flotilla which swept the Home Fleet through the German mine barrier in the Skagerrak just before VE-Day, and later escorted the Crown Prince of Norway back to Oslo.

COMMANDER E. R. MICKLEM has relinquished the post of general manager of the Elswick, Scotswood and Chertsey works of Vickers-Armstrongs, Limited, with effect from October 1, owing to increasing responsibilities as deputy chairman and managing director (engineering works and shipyards) of the company. MR. B. W. A. DICKSON has been appointed a director of Vickers-Armstrongs, Limited, and general manager of the aircraft section. MR. P. H. MUIRHEAD has been appointed a director and general manager of the Elswick, Scotswood and Chertsey works. SQD.-COMDR. SIR JAMES BIRD, R.N., relinquished the post of general manager of the company's Supermarine Works on September 30, and is appointed adviser to the managing director (aircraft) of the company from October 1.

FURTHER RELAXATIONS IN EXPORT CONTROL

Under the Export of Goods (Control) No. 7 Order, 1945, which came into operation on September 24, export licences will no longer be required for a very large number of items. The principal changes are:—

(*a*) Machinery has been removed entirely from export licensing requirements except for threshing machines and combine harvesters, contractors' plant, leather and well-drilling machinery, mobile cranes and textile machinery and plant made before April, 1941.

(*b*) Ball bearings have been removed.

(*c*) The list of metal manufactures has been greatly reduced and now only covers enamelled hollow-ware, gas meters, water taps, some nails and studs, a few specified hand tools, enamelled wire, and a few other goods in short supply.

(*d*) Semi-manufactures of some non-ferrous metals including copper and zinc, have been deleted.

(*e*) All vehicles and vehicle parts have been removed except vans, lorries, trucks, etc., and chassis and Diesel engines therefor; and tyres and tubes and some tractors.

(*f*) Instruments and apparatus, etc., are now free except surgical instruments and certain other appliances.

(*g*) Electrical goods have been reduced to two items, *viz.*, lead acid accumulators and cooking and heating appliances.

The goods remaining subject to licence are foodstuffs, many raw materials (some of which must be imported and paid for in dollars), clothing and other textiles, important chemicals and drugs, a strictly limited list of manufactured goods in short supply, arms and munitions and diamonds, and other items where there are special reasons for retaining control.

Exporters are advised to consult the Order itself to ascertain the position as regards goods with which they are concerned. Copies of the Order may be obtained directly or through any bookseller from H.M. Stationery Office, Kingsway, London, W.C.2, price 4d. (S.R. & O., No. 1146).

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NEWS IN BRIEF

IT IS OFFICIALLY ANNOUNCED that the price of quicksilver was reduced by £38 10s. per flask from October 1.

FIGURING ON THE German Black List are the names of Col. W. C. Devereux, and Dr. J. M. Robertson (joint editor, "Metal Treatment").

WOMBWELL (YORKS) URBAN COUNCIL has approved plans for the erection of a patternshop for the Wombwell Foundry & Engineering Company, Limited.

MR. ALEXANDER ROBERTSON, agent for the Steel Company of Canada, Limited, intimates that his address is now 4, Broad Street Place, London, E.C.2.

DRILLING OPERATIONS in South Africa are reported to have established the presence of hematite at a depth of 40 ft. near Boskop, on the main Johannesburg—Kimberley railway.

ST. SWITHIN'S ORES & METALS, LIMITED, is being wound up voluntarily. Mr. C. R. Goulder, of Deloitte, Plender, Griffiths & Company, 5, London Wall Buildings, London, E.C.2, is the liquidator.

THE CENTENARY of the Camelon Iron Company, Limited, was celebrated at a social function at which Mr. James M. Primrose, manager and director of the Falkirk companies of Federated Foundries, Limited, presided.

THE SCOTTISH OFFICE has signed a contract with G. & J. Weir, Limited, Cathcart, Glasgow, for 1,500 steel houses of four apartments, plus bathroom and scullery, which are to be completed at the new factory in Coatbridge within 12 months. Production has started.

THE WORKS of Jonathan Hattersley & Son, Limited, textile engineers and ironfounders, of Leeds, are being electrified throughout, and the general equipment is being brought up-to-date to meet modern requirements. To meet the outlay involved, the share capital of the company was in November last increased from £30,000 to £40,000.

RECENT NEGOTIATIONS between the Projectile & Engineering Company, Limited, the Ministry of Aircraft Production and the Board of Trade resulted in the Board of Trade allocating the Blythe Bridge factory to the company. The company, however, now announces that, having given consideration to the proposal, it is unable to accept the allocation.

THE LONDON TRAMP FREIGHT RATE COMMITTEE of the United Maritime Authority has issued 12 new freight rate schedules for compliance by shipowners in the United Nations Shipping Pool. They include manganese ore from Takoradi to Belgium at 53s. 6d. A reduction is shown in the rate for iron ore from Seville to the United Kingdom at 53s., against 60s.

MR. E. POPPLEWELL, M.P. for Newcastle-upon-Tyne West, has received an assurance from the Board of Trade that redundant space at the Scotswood works of Vickers-Armstrongs, Limited, will be used in the near future by engineering firms on civilian production. About 100,000 sq. ft. of factory space has become surplus in recent months and fears have been expressed for the future of the employees paid off.

MR. F. J. OSBORN, chairman of the Executive Committee of the Town and Country Planning Association, referred in an address at Bristol to the need for finding ways of promoting industrial development in new towns. He suggested that the Ministry of Town and Country Planning should have powers for this purpose similar to the powers of the Board of Trade in encouraging industries in the "development areas."

THE DIRECTORS of the Brightside Foundry & Engineering Company, Limited, Sheffield, state in their report for the year to June 30 last that they have for some time had under review the position created by the fact that the real capital employed in the business is out of proportion to the subscribed share capital. It is proposed, at the appropriate time, to capitalise some of the reserves and other funds shown in the balance-sheet. As a first step a resolution to increase the authorised capital from £250,000 to £500,000 by creating 1,000,000 new ordinary 5s. shares will be laid before the annual meeting.

OBITUARY

MR. LEONARD G. CARTER, managing director of the Carter Electrical Company, Limited, of Romford, died on September 22, aged 56.

MR. J. Y. FLETCHER, a director of the General Electric Company, Limited, for 30 years, died in London on September 21, after a short illness. He was 69.

MR. STANHOPE E. THORNTON, who died recently, was a director of William Sugg & Company, Limited, gas engineers, ironfounders, etc., of Westminster, London, S.W.1.

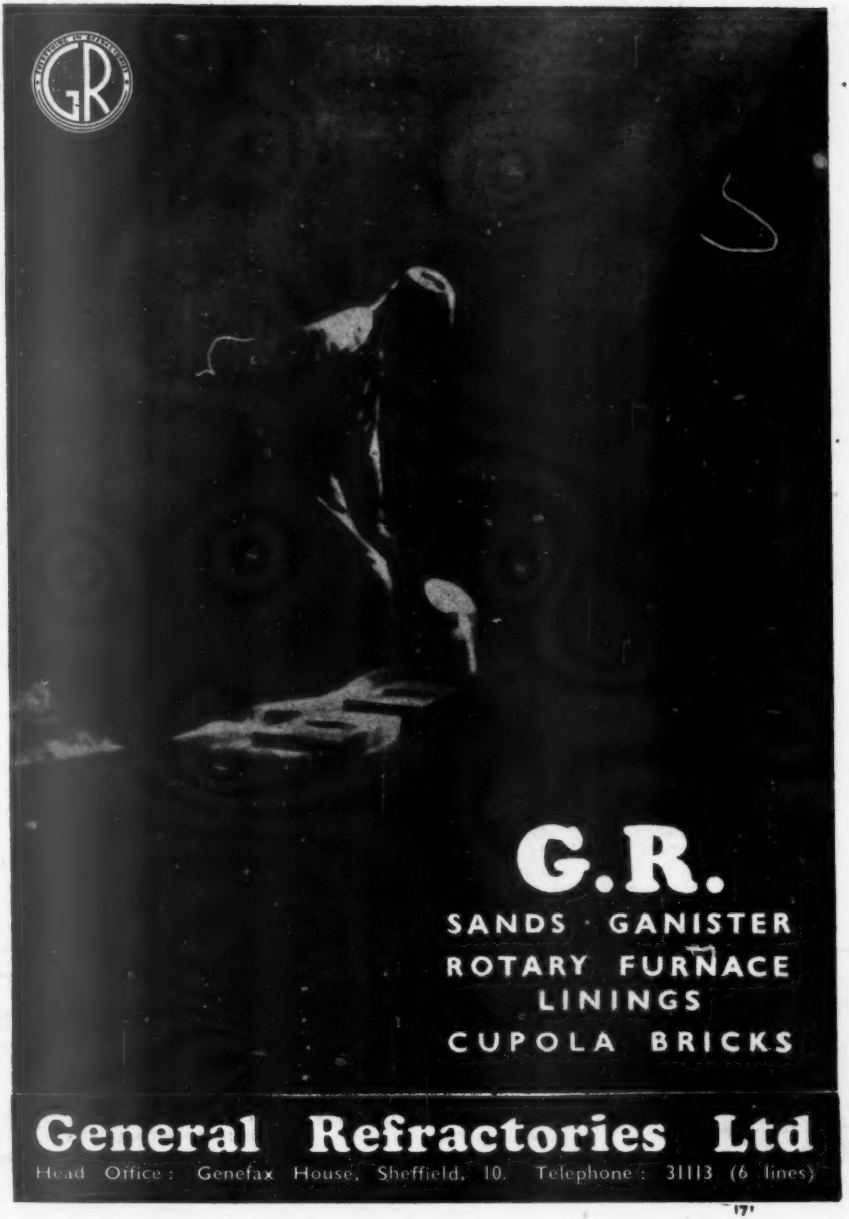
MR. A. D-G. MCBEAN, who has died at his home at Tettenhall, was an iron, steel and coke merchant, carrying on business in Darlington Street, Wolverhampton.

MR. FREDERICK CHARLES PUGSLEY, one of the original directors of Joseph Pugsley & Sons, Limited, engineers, machinery and metal merchants, of Bristol, died on September 24, aged 63. He was a son of the late Mr. Joseph Pugsley, founder of the firm.

A SOUTH AFRICAN S.O.S.

The South African branch of the Institute of British Foundrymen would be most grateful if our readers could help them to complete their records. They require copies of THE FOUNDRY TRADE JOURNAL for February 9, 1939, and May 20, 1943, and indices for Vol. 66 (January-April, 1942) and Vol. 72 (January-April, 1944).

Anyone who can give or sell his copies should communicate with Mr. John Bolton, acting secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, 3.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Raw Material Markets

IRON AND STEEL

Although the building of homes for the people ranks as a No. 1 priority, the execution of the housing programme has not yet been advanced beyond the preliminary stages. One of the essentials is the rapid expansion of the supply of light castings for the building industry, which will engage the maximum resources of the foundry trades. In the manufacture of baths, heating and cooking stoves, cast-iron pipes, etc., the light foundries are assured of full employment, and these establishments are already seeking licences for high-phosphorus iron in bigger tonnages than are at present available. Engineering and jobbing foundries are less favourably placed and these establishments experience no difficulty in acquiring special grades of iron suited to their needs. Production of basic iron is wholly reserved for either present or future requirements of the steelworks.

Re-rollers will enter upon the last three months of the year with a substantial volume of orders in hand for light sections, small bars, strip and sheets and still more business is in sight. Their chief difficulty is to secure the requisite tonnages of semi-finished steel. Production of billets is definitely below the current rate of consumption, and although users are ready to utilise defectives wherever possible, there is a shortage which may not be overcome until deliveries arrive from the Dominions. The almost unprecedented activity of the sheet trade calls for exceptionally heavy tonnages of sheet bars, but the steelmakers appear to be meeting all demands for this class of material.

A gradual improvement is reported in the heavy steel trade. Shipbuilders, boilermakers and manufacturers of rolling stock are maintaining a steady flow of specifications for plates, although there is a marked preponderance of light plates in the orders recently booked. Improvement in the position of the mills rolling heavy joists and sections is probably due to the export orders recently placed through the British Iron and Steel Corporation, home requirements being still on a relatively small scale. Colliery companies have already placed substantial contracts for steel arches, props and roofing bars for delivery to the end of the year, and it may be many months, or even years, before the rail mills are able to overtake the urgent call for supplies from the home railways and from abroad.

NON-FERROUS METALS

The news that the New York Commodity exchange is resuming dealings in metals early in 1946 will be received in this country with mixed feelings and some misgiving. Inevitably the thought arises that the American market will reopen in advance of the British market.

The rise in silver prices paves the way to a possible stimulation in lead production.

The British prices for quicksilver are being brought into line with the rest of the world prices. It is noteworthy that in the first six months of this year, America imported 28,000 flasks of mercury, and in July of this year 18,000 flasks.

Latest figures for American stocks of copper show a decrease of 60,000 short tons since July. Good news concerning tin comes from Singapore, where some 5,000 tons of tin discovered there will soon be shipped to Britain. From the same source it is learnt that although Singapore's only smelting works was out of action, the Japanese had been smelting ore in Malaya.

CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Horsham, October 8—Provision and laying of 492 yds. of 4-in. spun-iron main, etc., for the Urban District Council. Mr. A. Slyfield, clerk, Council Offices, Horsham Park, Horsham, Sussex.

Upton-on-Severn, October 8—Provision and laying of 3,400 yds. of 12-in., 9-in. and 6-in. dia. pipe sewers, etc., for the Urban District Council. Mr. H. Foster, clerk, Council Offices, Old Street, Upton-on-Severn.

SALE OF KENT ALLOYS, LIMITED

Following a recommendation by the board of Short Bros. (Rochester & Bedford), Limited, the Minister of Supply and Aircraft Production has agreed to the sale of Kent Alloys, Limited, to Dawnay, Day & Company, Limited, who have purchased the entire share capital.

The policy of the company will remain unchanged and, under the general managership of Mr. F. H. Hoult, the company will continue its business of manufacturing and machining high-grade aluminium, magnesium and heavy non-ferrous alloy castings.

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